Time is life

A non-specialist's comment on extraterrestrial life

D.S.L. Soares
Departamento de Física, ICEx, UFMG — C.P. 702
30161-970, Belo Horizonte — Brazil

January 30, 2002

Abstract

The affirmative statement of the existence of extraterrestrial life is tentatively raised to the status of a *principle*. Accordingly, Fermi's question is answered and the anthropic principle is shown to be falsifiable. The time-scale for the development of life on Earth and the age of the universe are the fundamental quantities upon which the arguments are framed.

1 Introduction

Life is an event which is intrinsically non-deductible from first principles. This idea, in a different context, has been claimed and argued by the biologist and Nobel laureate Jacques Monod in a book published in 1970 (Monod 1970).

On the grounds that life can neither be denied nor fully predicted, a further step follows, namely, the declaration of the existence of *extraterrestrial* life as a *principle* of Nature.

The main advantages of a principle for the existence of extraterrestrial life are: (i) the solution of paradox-like statements concerning extraterrestrial life (e.g., Fermi's question), (ii) the suppression of geo- and anthropocentric ideas, and (iii) the creation of a logical basis for future theoretical and experimental investigations. In practice the latter means that one does not need

to justify any scientific project on extraterrestrial life searches (for example, Sagan and Drake 1975) regarding its logical foundations: the principle provides (is) the foundation.

The crucial experiment for the origin of life has not to be done; it was already done on Earth. It seems fair to believe that given a set of yet unknown environmental conditions life is bound to flourish. Examples of such a conception, i.e., that life is not a privilege of our local environment, are multiple in the literature, from the early incursions by Giordano Bruno (e.g., Gatti 1999) and Christiaan Huygens (1798) through the modern ages with Robert Goddard (see Sagan 1979), Sagan and Salpeter (1976), and others.

It is worthwhile pointing out that the meaning of life used here is definitely not restricted to carbon-based organisms developed upon watery substrates. A broader concept is envisaged, which is not new and may be found, for example, in the investigations by Sagan and Salpeter (1976) of a possible Jovian ecology, or in the literary speculations of a living interstellar cloud, by Hoyle (1957), and of a structured cometary mind, by MacLeod (2000) — incidentally, both likely being fed by some sort of ubiquitous cosmic plankton.

Asserting the precise meaning of life is otherwise beyond the scope of the present note; the reader is referred to the above-mentioned book by Monod for a thorough discussion on the definition of a living organism.

2 Time is life: a principle

The principle is set up along the following two lines of arguments. (1) The existence of life on Earth affirms the crucial experiment for the existence of life. (2) The universe is empirically found to be at least three times as old as life on Earth. The age of the oldest stars in the Milky Way is taken as a *lower* limit estimate for the age of the universe, and the age of the solar system as an *upper* limit estimate for the age of life on Earth. Both time-scales are observational facts resting on well-established scientific studies. The first one, on the physics of energy production in stars, and the second one, on the laws of radioactive decay applied to meteorites.

The universe is old enough such that life and a local ecology are expected features of any environment.

Time is life, that is to say, give it *time* and *life* is the irremediable end product.

3 Discussion

In the light of the principle, a number of other topics deserve renewed attention. Below, four of them are briefly touched: Fermi's question, the anthropic principle, extraterrestrial intelligence and panspermia.

The famous question posed by Enrico Fermi in an informal conversation during a lunch at Los Alamos, in the summer of 1950 [see later account by Eric M. Jones (1985)], became central in the discussion of the existence of extraterrestrial civilizations (e.g., Newman and Sagan 1981). *"— Where is everybody?"*, asked Fermi, talking about extraterrestrial life. The answer to Fermi's question is plain and uninteresting: *"— They are where they belong to"*. Yet they are, states the extraterrestrial life principle.

The anthropic principle (see, for example, Barrow and Tipler 1988), which certainly with justice should be dubbed *the masterpiece of human arrogance*, is thus irrelevant since the human ecology is but one amongst many.

The search for extraterrestrial intelligence (e.g., the SETI project, see `http://seti.planetary.org/`) is strengthened by the principle. But an eventual absence of contact with extraterrestrial civilizations should not be confused with their non-existence. Establishing contact with alien populations is not a prerogative of intelligent life but of a given cultural and social characteristic of intelligent life (e.g., mercantilism, in the case of mankind, as a driving force for contact between distinct societies on Earth in the XV and XVI century).

Finally, it is important to remark that the acceptance, or the eventual empirical verification, of the so-called *panspermia paradigm* (see electronic links to this and related issues in `http://www.panspermia.org/`) makes the extraterrestrial life principle obvious.

Acknowledgment — I would like to thank Dr. André K.T. Assis for comments and suggestions on a earlier version of the manuscript.

References

Barrow, J.D. and Tipler, F.J. (1988) The Anthropic Cosmological Principle, Oxford University Press, Oxford.

Gatti, H. (1999) Giordano Bruno and Renaissance Science, Cornell University Press, Ithaca.

Hoyle, F. (1957) The Black Cloud, Buccaneer Books, Inc., New York.

Huygens, C. (1798) The Celestial Worlds Discovered: Conjectures Concerning the Inhabitants, Planets and Productions of the Worlds in the Planets, Timothy Childs, London.

Jones, E.M. (1985) 'Where is Everybody?' An Account of Fermi's Question, Los Alamos National Laboratory Report LA-10311-MSF, `http://lib-www.lanl.gov/la-pubs/00318938.pdf`.

MacLeod, K. (2000) The Oort crowd. Nature, 406, 129.

Monod, J. (1970) Le Hasard et la Necessité, Editions du Seuil, Paris, chap. II.

Newman, W.T. and Sagan, C. (1981) Galactic civilizations: Population dynamics and interstellar diffusion. Icarus, 46, 293-327.

Sagan, C. (1979) Broca's Brain: Reflections on the Romance of Science, Random House, New York, chap. 18.

Sagan, C. and Drake, F. (1975) The search for extraterrestrial intelligence. Scientific American, 232, 80-89.

Sagan, C. and Salpeter, E.E. (1976) Particles, environments, and possible ecologies in the Jovian atmosphere. Astrophys. J. Supp., 32, 737-755.